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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/782,558	02/13/2001	Carlo Rubbia	P-6150	9660

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EXAMINER

PALABRICA, RICARDO J

ART UNIT	PAPER NUMBER
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3641

DATE MAILED: 10/01/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/782,558

Applicant(s)

RUBBIA, CARLO

Examiner

Rick Palabrica

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 August 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 25-31, 33, 36-45, 47-70 and 72-94 is/are pending in the application.
- 4a) Of the above claim(s) 30, 31, 51, 56 and 57 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 25-29, 33, 36-45, 47-50, 52-55, 58-70 and 72-94 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Applicant's Amendment C in Paper No. 24, which directly amends claim 25 and adds new claims 74-94, is acknowledged. This amendment is in response to the 5/7/03 Office Action.

2. Applicant amended claims 25 and 49 to overcome the rejections under 35 U.S.C. 112, 1st and 2nd paragraphs by deleting the objectionable limitation, *"wall having a front face coated with fissile material arranged to expose the fissile material to a neutron flux for inducing fission and release of fission fragments into the chamber."* The Examiner agrees that this deletion renders said rejection moot.

3. Applicant then states that he re-introduces a "whereby" clause into revised claims 25 and 49, which was not objected to by the Examiner in the 10/16/02 Office Action, i.e., *"whereby exposure of the fissile material to a neutron flux causes fission and the release of fission fragments into the chamber."* The Examiner notes that this "whereby" clause is different from that examined in the 10/16/02 Office Action, because of the new limitation, *"to interact with the gas circulating through said chamber"*, which has been added to the claim language after the word, *"chamber"*. Therefore, the alleged previous "non-objection by the examiner" does not apply to the examination of the current claims. The new clause has to be re-evaluated, and, in fact, it gives rise to new issues under 35 U.S.C. 112, as discussed below.

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4. Applicant alleges that the new "whereby" clause is a claim limitation. The Examiner disagrees because it is still a statement of intended or desired use. The clause describes how the claimed invention expects to function. See also section 5 below.

5. Applicant traversed the use of Bingham et al. as a secondary reference to modify Culver. He alleges that Bingham et al. teaches away from the claimed fuel arrangement because their fuel elements: a) do not have front faces coated with fissile; and b) said front faces are coated with zirconium carbide that blocks fission products.

Applicant's arguments have been fully considered but they are not persuasive. The above-cited features upon which the applicant relies are not recited in rejected claims. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Additionally, if said unrecited features are considered by the applicant to be critical to his invention, then such omission would amount to a gap between the essential elements. In this case, the claim(s) would be incomplete and would be rejected under 35 U.S.C. 112, second paragraph. See MPEP § 2172.01.

As to the applicant's traverse of Bingham et al., note first that they clearly disclose that nuclear fuel is applied to cylinders 12 by "coating or impregnating the cylinder base material with the desired fuel" (see column 2, lines 54+). Thus, fissile material coating is provided on the front face of the innermost cylinder element 12, and applicant's claim language, "chamber", reads on said innermost cylinder.

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Second, the claims recite the inclusive, open-ended transitional term "comprising", which is synonymous with "including", "containing", or "characterized by", and does not exclude additional, unrecited elements. See, e.g., MPEP 2111.03 and *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501, 42 USPQ2d 1608, 1613 (Fed. Cir. 1997) ("Comprising" is a term of art used in claim language which means that the named elements are essential, but other elements may be added and still form a construct within the scope of the claim). Therefore, another layer, e.g., zirconium carbide, on the nuclear fuel coating is not precluded by the claims.

Third, the amended claims recite, "means for cooling the rear face of the wall of said chamber, *whereby exposure of the fissile material to a neutron flux causes fission and the release of fission fragments into the chamber interact with the gas circulating through said chamber.*" This language implies that providing said cooling means will ensure that the limitation stated in the "whereby" clause is met. The claim does not specify any parameters for the cooling means. When the fuel element of Bingham et al. is used in combination with the reactor of Culver, there is cooling provided for the rear face of the element. Therefore, applicant's claim limitation in the "whereby" clause is met by the Culver-Bingham et al. combination.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

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The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 25-29, 33, 36-45, 47-50, 52-55, 58-70, and 72-94 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Independent claims 25, 49, 74, 84 and 91 recite the limitation "means for cooling the rear face of the wall of said chamber, whereby exposure of the fissile material to a neutron flux causes fission and the release of fission fragments into the chamber."

There is neither an adequate description nor enabling disclosure as to how and in what manner providing a means for cooling of the rear face of the chamber **alone will ensure or result** in exposure of the fissile material to a neutron flux that causes fission and release of fission fragments into the chamber.

7. Claims 25-29, 33, 36-45, 47-50, 52-55, 58-70, and 72-94 are rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements. See MPEP § 2172.01. The omitted elements are specific features that ensure release of fission fragments into the chamber to interact with the circulating gas. See sections 5 and 6 above.

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8. Claims 25-29, 33, 36-45, 47-50, 52-55, 58-70, and 72-94 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The claims contain functional phrases or clauses such as "whereby" clauses (e.g. see claims 25 and 49), the content of which does not inherently follow from the actual structure recited. Thus, the scope of the claims and/or the metes and bounds thereof cannot be determined. Said clauses accordingly raise a question as to the limiting effect of the language therein on the claims (see MPEP 2106.II.C).

A broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite, since the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. Note the explanation given by the Board of Patent Appeals and Interferences in *Ex parte Wu*, 10 USPQ2d 2031, 2033 (Bd. Pat. App. & Inter. 1989), as to where broad language is followed by "such as" and then narrow language. The Board stated that this can render a claim indefinite by raising a question or doubt as to whether the feature introduced by such language is (a) merely exemplary of the remainder of the claim, and therefore not required, or (b) a required feature of the claims. Note also, for example, the decisions of *Ex parte Steigewald*, 131 USPQ 74 (Bd. App. 1961); *Ex parte Hall*, 83 USPQ 38 (Bd. App. 1948); and *Ex parte Hasche*, 86 USPQ 481 (Bd. App. 1949). In the present instance, claims 27, 53, 76 and 94, for instance, recite the broad recitation of a fissile content lower than 10 mg/cm², and the

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claims also recite preferably in the range 1 to 3 mg/cm², which is the narrower statement of the range/limitation.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 25, 26, 28, 29, 33, 36-39, 42-45, 49, 50, 54-56, 58-64, 67-70, 74, 75, 77-81, 84-88, and 91 are rejected under 35 U.S.C. 103(a) as being unpatentable over Culver (U.S. 5,873,239) in view of Bingham et. al (U.S. 4,759,911) and Etherington (Nuclear Engineering Handbook). Culver discloses the applicant's claims except for the fissile material-coated chamber and the reflector.

Culver discloses a nuclear rocket engine comprising a gas heating device (Fig. 1) including at least one chamber for containing gas, i.e., hollow fuel assembly (48), means for cooling the rear face of the chamber (see coolant flow on the outer surface of fuel assembly, and a means for expelling the heated gas into space to generate thrust (see nozzle 10). Culver further discloses (see Fig. 4) a neutron reflector (52) surrounding the enclosure of the gas heating device, said reflector having cavities for receiving removable neutron-absorbing control rods (see numeral 76 and column 5, lines 55+). Culver uses a gaseous hydrogen propellant (see column 8, lines 65+) and beryllium reflector (see column 5, lines 58+). Culver further discloses a chamber cooling

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circuit that is separate from the propellant circuit, said “means for cooling the chamber” as being located at a “rear face” of said chamber (e.g., numeral 34, Fig. 2).

Culver does not disclose details about the fuel assemblies but teaches that they are of conventional construction (see column 4, lines 60+). Bingham et. al disclose a gas-cooled fuel element for space power and propulsion applications (see column 1, lines 10+). They teach that their fuel element provides optimum power density (see column 1, lines 66+ and column 2, lines 13+). Bingham et. al show this fuel element in their figure as a cylinder wherein americium carbide is coated on the cylinder base material (see column 2, lines 40+). Applicant’s claim language “chamber” reads on Bingham et. al’s cylindrical base material.

One having ordinary skill in the art would have recognized that Bingham et al.’s fuel element is well known in the nuclear rocket art, i.e., it is conventional, and advantageous because of its optimum characteristics.

As to the limitation regarding the reflector having a thickness of at least $50/d$, where d = density of carbon material, this yields a thickness of at least 22 cm, based on a graphite density of 2.22 gm/cm^3 . As stated in the 5/7/03 Office Action, Etherington teaches that graphite has a thermal diffusion length = 51.8 cm (see Table 24, page 1-20). Both carbon (in the form of graphite) and beryllium are well-known neutron reflector materials. In the 4/17/02 Office Action, the Examiner also stated that it is well known in the nuclear art that a reflector should have a thickness of at least one thermal diffusion length in order to be effective, and to use a 51.8 cm thickness for the graphite reflector would have been prima facie obvious.

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Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the nuclear rocket, as disclosed by Culver, by the teaching of Bingham et. al and Etherington, to gain the advantages thereof (e.g., optimum power density), in order to have a space engine, comprising: a) at least one open chamber having a wall, said wall having a front face coated with an americium carbide fissile material and a rear face; b) inlet means for introducing gas into the chamber; c) outlet means for evacuating gas circulated through said chamber from the inlet means; d) a neutron reflector comprising a thickness of at least 50/d cm; e) means for cooling the rear face of the chamber, as this no more than the use of a well-known fuel material and reflector configuration in the nuclear rocket art. See also the discussion in section 5 above regarding Bingham et al.

The claims are replete with statements that are either essentially statements of intended or desired use, e.g., the whereby clause discussed above, "for receiving removable neutron-absorbing control rods, "for receiving the heated gas," etc. These clauses, as well as other statements of intended use do not serve to patently distinguish the claimed structure over that of the reference, as long as the structure of the cited references is capable of performing the intended use. See MPEP 2111-2115.

See also MPEP 2114 that states:

A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647.

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Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531.

[A]pparatus claims cover what a device is, not what a device does.” *Hewlett-Packard Co. v. Bausch & Lomb Inc.*, 15 USPQ2d 1525, 1528.

As set forth in MPEP 2115, a recitation in a claim to the material or article worked upon does not serve to limit an apparatus claim.

The system cited above is capable of being used in the same manner and for the intended or desired use as the claimed invention.

10. Claims 27, 53, 76 and 94 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Culver - Bingham et. al - Etherington combination, as applied to claims 25, 26, 28, 29, 33, 36-39, 42-45, 49, 50, 54-56, 58-64, 67-70, 74, 75, 77-81, 84-88, and 91 and further in view of IDS document C2, Chikin et al. “Gas Heating by Fission Fragments in the Channel of a Pulsed Reactor,” *Atomnaya Energiya*, December 1988, USSR, Vol. 65, No. 6). The combination as discussed above in section 9 discloses the applicant’s claims except for the specifics on the thickness of the fissile material.

As to the limitation in said claims of having a fissile content of lower than 10 mg/cm³, Chikin discloses a gas-filled channel of a pulsed reactor wherein a layer of highly enriched nuclear fuel (90% ²³⁵U) of thickness 2.5 microns is applied to the inner surface of the graphite wall of said channel. Based on a density of uranium = 19 gm/cm³ (e.g., see H. Etherington, *Nuclear Engineering Handbook*), the thickness of the nuclear fuel is equivalent to 4.7 mg/cm³.

One having ordinary skill in the art would have recognized that the fuel elements of Chikin et al. is similar to that of Bingham et al., i.e., uranium carbide on a wall of

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graphite (see Abstract of Chikin and column 3, lines 10+ of Bingham et al.). Therefore, modification of the cited combination to have included the teaching of Chikin would have been obvious to one having ordinary skill in the art at the time the invention was made, as such results are in no more than utilization of known techniques in the nuclear art, and the substitution of one well-known embodiment of a nuclear fuel element by another well-known element.

11. Claims 40, 41, 47, 48, 65, 66, 72, 73, 82, 83, 89, 90, 92 and 93 are rejected under 35 U.S.C. 103(a) as being unpatentable over the Culver - Bingham et. al - Etherington combination, as applied to claims 25, 26, 28, 29, 33, 36-39, 42-45, 49, 50, 54-56, 58-64, 67-70, 74, 75, 77-81, 84-88, and 91.

As stated by the Examiner in the 4/17/02 Office Action, the limitation in said claims regarding the use of ^7Li as coolant is a well-known expedient in the nuclear art because of its good heat-absorbing capacity and its low molecular weight. Said statement was not seasonably traversed by the applicant, and therefore, this object of the well-known statement are taken to be admitted prior art. See MPEP 2144.03. Accordingly, the use ^7Li as a substitute coolant for hydrogen in the Culver - Bingham et. al - Etherington combination would be prima facie obvious.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

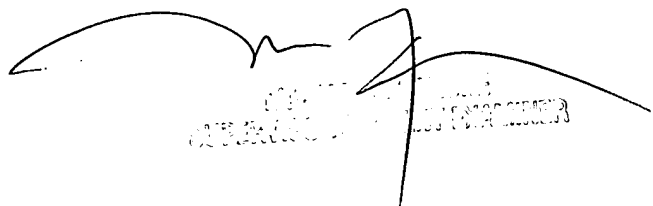
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rick Palabrica whose telephone number is 703-306-5756. The examiner can normally be reached on 7:00-4:30, Mon-Fri; 1st Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Carone can be reached on 703-306-4198. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-1113.

RJP
September 29, 2003

A handwritten signature in black ink is written over a rectangular official stamp. The stamp contains the text "COMMUNICATIONS SECTION" and "SEP 30 2003" in a grid-like format.